NASA TECH BRIEF

Visco Seal Design Offers Zero-Leakage and Wear-Free Characteristics

The problem:

In the field of bulk liquid transfer in batch plants or refinery systems, wear and leakage rates in continuous duty pump shaft seals are of considerable concern. Some data for the evaluation of fluid tensile strength characteristics is available in the 10^3 to 10^4 reciprocal seconds area, but the behavior of fluids in the range of 10^6 reciprocal seconds is not established as a design criterion although some dynamic seals may operate at this level of shear rate.

The solution:

A study that results in specific design criteria in sealing applications for continuous duty pumps in various applications. A basic sealing equation is developed to predict visco seal performance in the turbulent regime.

How it's done:

Data is produced to indicate the most favorable geometry for the highest sealing effectiveness for a given set of operating parameters. The visco seal is a noncontacting dynamic seal that uses fluid viscous forces to accomplish the sealing function. It essentially is a "screw pump" operating at zero flow against a pressure differential (pressure to be sealed). The conventional configuration is a threaded shaft member consisting of helical lands operating within a close tolerance sleeve. Considering the numerous geometric and hydrodynamic parameters of interest, a generalized sealing equation suitable for computer evaluation is evolved. This permits variation of the visco seal design for optimization in a broad field of applications. Results of the computer study show that good performance is obtainable over a wide range of geometric variables. It is specifically established that for a given helix angle, there is a particular value of the nondimensional clearance that maximizes the nondimensional sealing coefficient. In general, the optimum value of the nondimensional clearance shifts very gradually towards lower values as the Reynolds number increases. The maximum value of the nondimensional sealing coefficient is relatively constant over a wide range, increasing slightly towards the area of smaller helix angles.

Notes:

1. These design criteria should be of interest to designers of boiler feed pumps, process plant pumps, or refinery pumps continuously transferring liquids in both the laminar and turbulent regimes.
2. Other design consideration, such as correlation of theory and experiment, gas ingestion, end effects, and scavenging, are discussed in the following references:
   A. NASA TM X-52245, "Experimental and Theoretical Study of the Viscoseal," by John Zuk, L. P. Ludwig, and R. L. Johnson.
   B. Paper entitled "Turbulent Operation of the Visco Seal," by H. N. Ketola and J. M. McGrew of General Electric, presented at the ASLE/ASME Lubrication Conference in Minneapolis, Minnesota, October 18 through 20, 1966.
3. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Western Support Office
   150 Pico Boulevard
   Santa Monica, California 90406
   Reference: B67-10047

(continued overleaf)

Patent status:

No patent action is contemplated by NASA.

Source: H. Norman Ketola and J. M. McGrew
of General Electric Company
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